CLAIMS

I/We claim:

[c1] 1. A method for treating a neural condition, comprising:

positioning an electromagnetic transmitter within transmission range of a target neural population; and

transmitting a series of electromagnetic signals from the electromagnetic transmitter to the target neural population, so that each of at least some of the signals has a target temporal relationship to a corresponding one of a series of discharges from the target neural population, wherein the corresponding discharges are or would be transmitted by the neural population absent the signals.

[c2] 2. The method of claim 1 wherein transmitting the signals includes transmitting the signals so that each of at least some of the signals precedes a corresponding one of the series of discharges from the target neural population by a target period of time.

[c3] 3. The method of claim 1 wherein transmitting the signals includes transmitting the signals so that each of at least some of the signals at least approximately coincides with a corresponding one of the series of discharges from the target neural population.

[c4] 4. The method of claim 1 wherein transmitting the signals includes transmitting the signals so that each of at least some of the signals follows a corresponding one of the series of discharges from the target neural population by a target period of time.

[c5] 5. The method of claim 1 wherein transmitting the signals includes at least inhibiting a consequence of the neural discharges.

[c6] 6. The method of claim 1 wherein transmitting the signals includes augmenting a consequence of the neural discharges.

[c7] 7. The method of claim 1, further comprising detecting the neural discharges, or consequences of the neural discharges, or both.

[c8] 8. The method of claim 1, further comprising detecting the neural discharges, or consequences of the neural discharges, or both, and selecting a timing of the signals based at least in part on results of the detection.

[c9] 9. The method of claim 1 wherein transmitting each of at least some of the signals includes transmitting the signals at a target time of from about 1 to about 25 milliseconds prior to corresponding discharges from the target neural population.

[c10] 10. The method of claim 1 wherein transmitting each of at least some of the signals includes transmitting the signals at a target time of more than 5 milliseconds prior to corresponding discharges from the target neural population.

[c11] 11. The method of claim 1 wherein transmitting each of at least some of the signals includes transmitting the signals at a target time of from about 10 to about 100 milliseconds prior to corresponding discharges from the target neural population.

[c12] 12. The method of claim 1 wherein the neural discharges are naturally occurring neural discharges.

[c13] 13. The method of claim 1 wherein the neural discharges are naturally occurring neural discharges associated with at least one of essential tremor, Parkinson's Disease, epilepsy, a psychiatric disorder, and pain.

[c14] 14. The method of claim 1, wherein the neural discharges are transmitted to a muscle, and wherein the method further comprises using a detector to detect activity of the muscle triggered by the neural discharges.

[c15] 15. The method of claim 1 wherein transmitting the signals includes transmitting the signals at a subthreshold level.

[c16] 16. The method of claim 1 wherein transmitting the signals includes transmitting the signals from an electrode implanted within the skull of a patient.

[c17] 17. The method of claim 1 wherein transmitting the signals to the target neural population includes transmitting the signals to neural tissue located in the brain of a patient.

[c18] 18. The method of claim 1 wherein each of at least some of the signals includes a pair of pulses.

[c19] 19. The method of claim 1 wherein each of at least some of the signals includes a single pulse.

[c20] 20. The method of claim 1 wherein each of at least some of the signals includes a burst of pulses.

[c21] 21. The method of claim 1 wherein each of at least some of the signals include a burst of pulses having a frequency of from about 1 to about 2500 Hz.

[c22] 22. The method of claim 1 wherein each of at least some of the signals is separated from an adjacent signal by from about 3 to about 15 Hz.

[c23] 23. The method of claim 1, further comprising selecting at least one of several electrodes positioned proximate to the target neural population from which to transmit the signals.

[c24] 24. The method of claim 1, further comprising transmitting the signals via a plurality of electrodes positioned at least proximate to the target neural population.

[c25] 25. The method of claim 1 wherein the neural discharges are internally triggered.

[c26] 26. The method of claim 1 wherein the neural discharges are externally triggered.

[c27] 27. The method of claim 1, further comprising triggering the neural discharges via stimulation external to a patient, and wherein transmitting the signals includes at least inhibiting a consequence of the neural discharges in the patient.

[c28] 28. The method of claim 1, further comprising triggering the neural discharges via stimulation external to a patient, and wherein transmitting the signals includes augmenting a consequence of the neural discharges in the patient.

[c29] 29. A method for treating a neural condition, comprising:

implanting an electrode within a patient's skull;

detecting an indication corresponding to a naturally occurring series of discharges transmitted by a neural population within the patient's skull;

transmitting a series of electrical signals from the electrode to the neural population;

for at least some of the electrical signals, controlling each electrical signal to have a target temporal relationship to a corresponding one of the discharges; and

updating a schedule according to which the electrical signals are transmitted based on the detected indications.

[c30] 30. The method of claim 29 wherein detecting an indication includes detecting an indication associated with at least one of a movement disorder, Parkinson's Disease, a pain state, a psychiatric condition and epilepsy.

[c31] 31. The method of claim 29, further comprising selecting at least one of an amplitude, pulse width, frequency, and timing of the electrical signal.

[c32] 32. The method of claim 29 wherein detecting an indication includes detecting a neural discharge.

[c33] 33. The method of claim 29 wherein detecting an indication includes detecting a muscle activity associated with the neural discharge.

[c34] 34. The method of claim 29 wherein controlling each signal and updating a schedule are performed by a computer-readable medium.

[c35] 35. An apparatus for treating a neural condition, comprising:

a transmitter configured to transmit a series of electromagnetic signals to a target neural population of a patient;

a detector configured to receive an indication corresponding to a series of neural discharges that are or would be discharged by the neural population in the absence of the signals; and

a controller operatively coupled to the detector and the transmitter to control delivery of the signals to have a target temporal relationship with the neural discharges.

[c36] 36. The apparatus of claim 35 wherein the controller is configured to update a schedule according to which the signals are transmitted, based on changes in the received indications.

[c37] 37. The apparatus of claim 35 wherein the controller and the transmitter are configured to transmit electrical pulses at a subthreshold level.

[c38] 38. The apparatus of claim 35 wherein the controller is configured to control delivery of the signals to precede corresponding neural discharges by from about 1 millisecond to about 25 milliseconds.

[c39] 39. The apparatus of claim 35 wherein the controller is configured to control delivery of the signals to precede corresponding neural discharges by from about 10 milliseconds to about 100 milliseconds.

[c40] 40. The apparatus of claim 35 wherein the controller is configured to control delivery of the signals to precede corresponding neural discharges by more than 5 milliseconds.

[c41] 41. The apparatus of claim 35 the transmitter includes at least one implantable electrode.

[c42] 42. The apparatus of claim 35 wherein the transmitter includes a plurality of electrodes configured to be implanted within a patient's skull.

[c43] 43. The apparatus of claim 35 wherein the detector is configured to detect the neural discharges.

[c44] 44. The apparatus of claim 35 wherein the detector is configured to detect muscle activity associated with the neural discharges.

[c45] 45. The apparatus of claim 35 wherein the detector and the controller are configured to communicate with each other by telemetry.

[c46] 46. The apparatus of claim 35 wherein the transmitter includes an implantable pulse generator.

[c47] 47. The apparatus of claim 35 wherein the controller includes a computer-readable medium configured to control delivery of the signals to have a target temporal relationship with the neural discharges.

[c48] 48. A method for treating a neural condition, comprising:

providing a reference stimulus to a patient; and

transmitting an electromagnetic signal to a target neural population of the patient, wherein the electromagnetic signal has a target temporal relationship to the reference stimulus.

[c49] 49. The method of claim 48 wherein providing a reference stimulus includes providing a reference sensory stimulus.

[c50] 50. The method of claim 48 wherein providing a reference stimulus includes providing a reference sensory stimulus external to the patient.

[c51] 51. The method of claim 48 wherein transmitting an electromagnetic signal includes transmitting an electrical signal from an electrode implanted within the patient.

[c52] 52. The method of claim 48 wherein transmitting an electromagnetic signal includes transmitting an electromagnetic signal that precedes a discharge from the target neural population, the discharge being in response to the reference stimulus.

[c53] 53. The method of claim 48 wherein the electromagnetic signal follows the reference stimulus by a target period of time.

[c54] 54. An apparatus for treating a neural condition, comprising:

a transmitter configured to transmit an electromagnetic signal to a target neural population of a patient; and

a controller operatively coupled to the transmitter, the controller being configured to control transmission of the signal from the transmitter to have a target temporal relationship relative to a reference stimulus delivered to the patient.

[c55] 55. The apparatus of claim 54 wherein the controller is configured to receive an indication of the delivery of the reference stimulus to the patient and control transmission of the signal from the transmitter based at least in part on the indication.

[c56] 56. The apparatus of claim 54 wherein the controller is configured to direct delivery of the reference stimulus to the patient.

[c57] 57. The apparatus of claim 54 wherein the transmitter includes at least one implanted electrode.

[c58] 58. The apparatus of claim 54 wherein the controller is configured to control transmission of the signal from the transmitter to have a target temporal relationship relative to a reference sensory stimulus delivered to the patient.

[c59] 59. The apparatus of claim 54 wherein the controller is configured to control transmission of the signal from the transmitter to have a target temporal relationship relative to a reference sensory stimulus external to the patient.